Cocoa Advanced View Techniques

Session 146

These are confidential sessions—please refrain from filming or taking pictures.

Application Technologies

Cocoa Advanced View Techniques

Getting the most from Tiger

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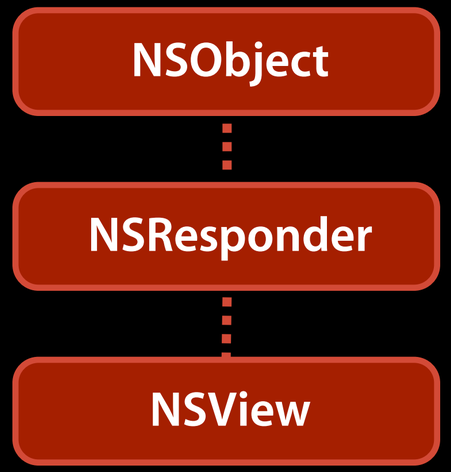
http://developer.apple.com/wwdc2005/

Views

The basic building blocks of window content

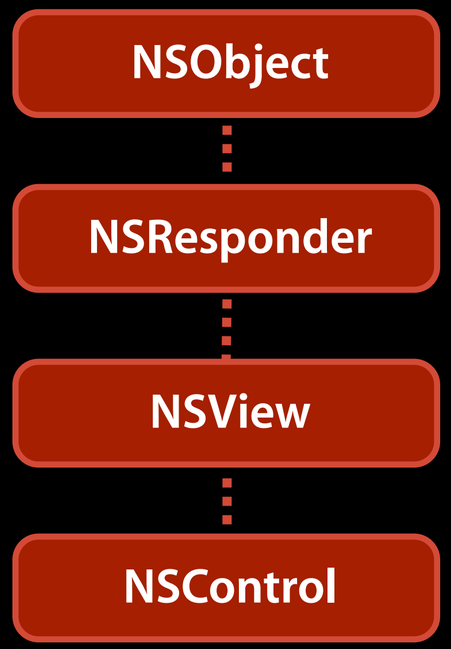
- Your application's interface to its users
- "Rectangles of responsibility"
  - Display content
  - Handle user input (mouse, keyboard events)
  - Nestable
  - Support coordinate transforms (translation, scaling, rotation)
  - Participate in the Responder chain
  - Support drag-and-drop
  - Part of a unified drawing/printing architecture
  - …and lots more! Tool tips, cursor management, tracking rects…



Views

The basic building blocks of window content

- Controls are views, too!
  - Delegate drawing, event-handling responsibility to an associated cell(s)
  - Can have an integer “tag”

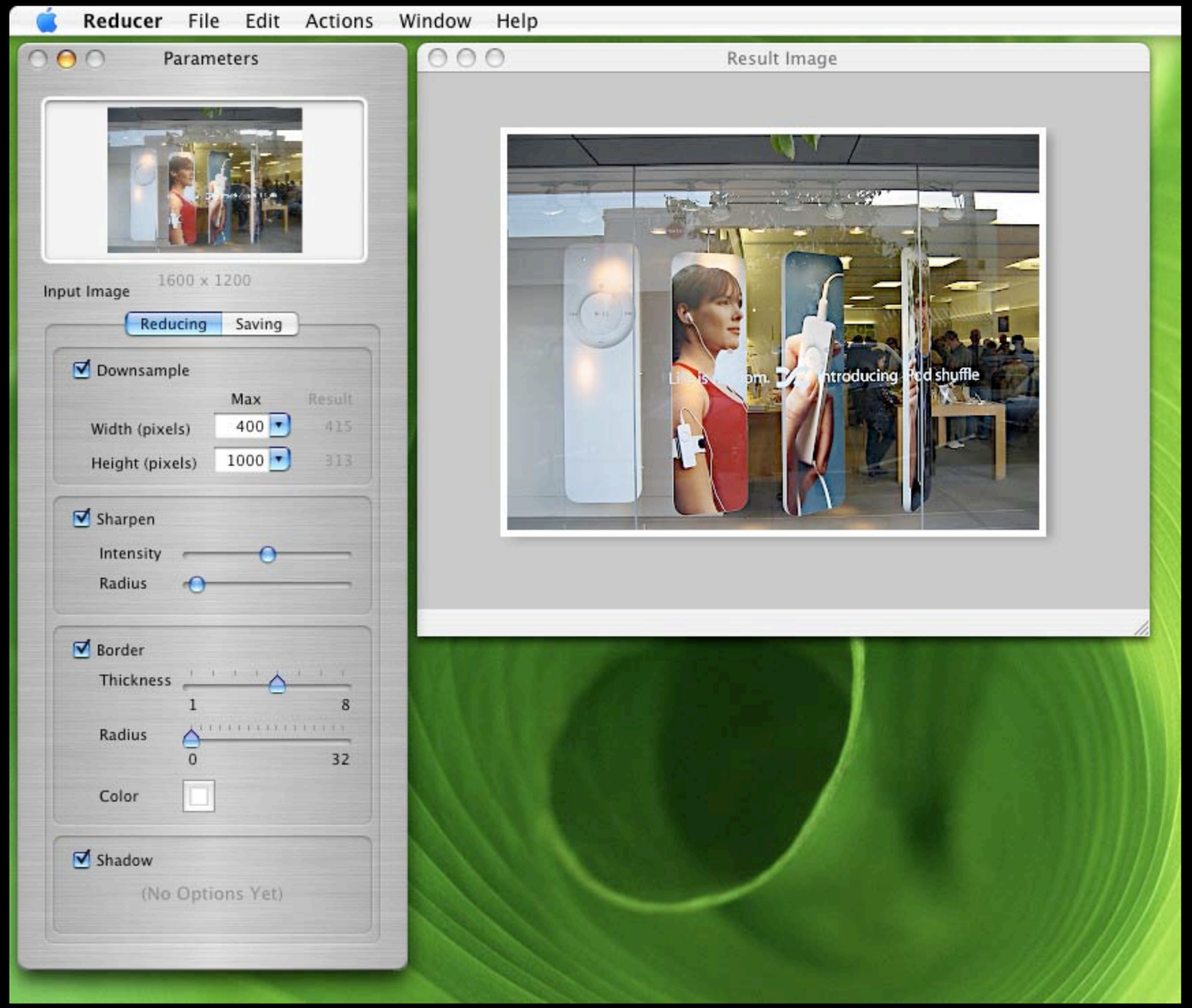


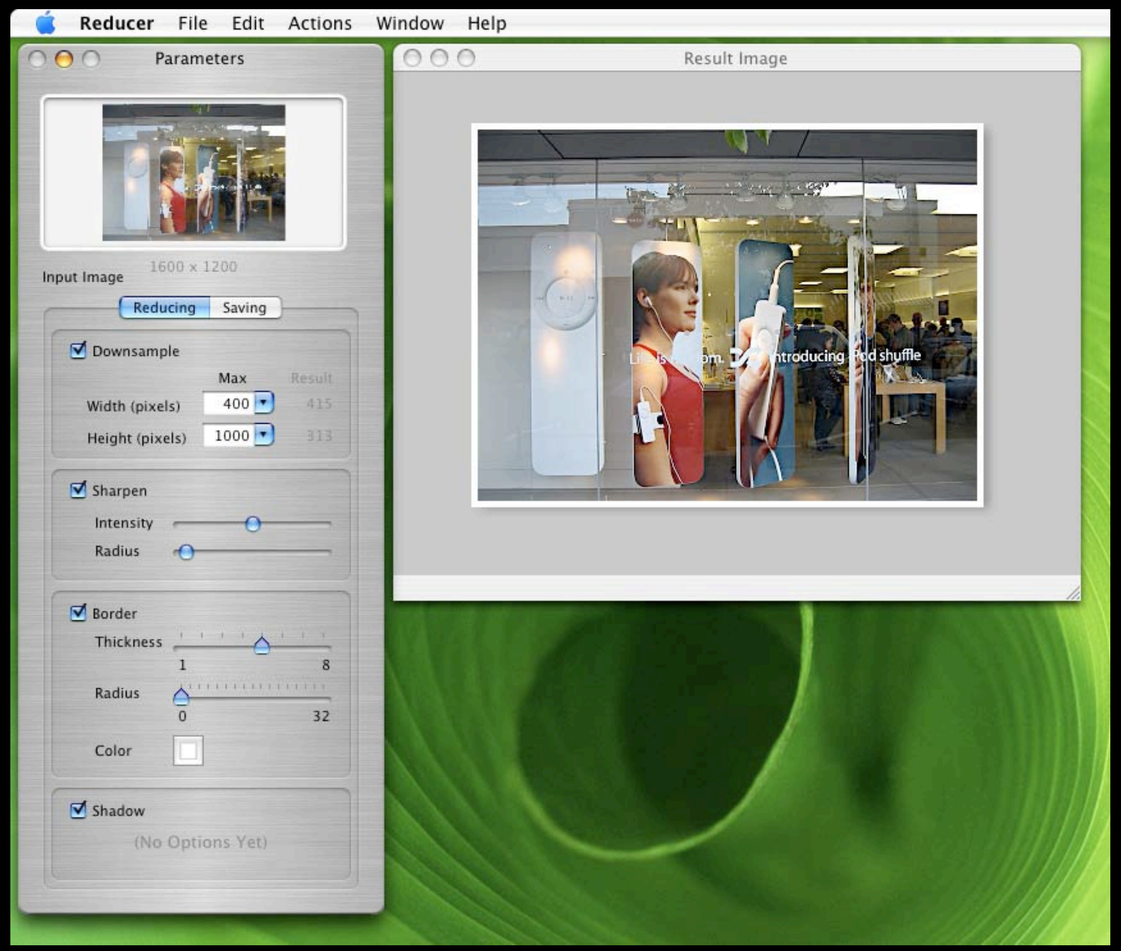
Introducing iPod shuffle
1600 X 1200

320 X 240

Today's Sample Project

"Reducer": a small image processing tool





Sample Project

Features

- Downsampling to fewer pixels
- Sharpening
- Adding a border
- Adding a drop shadow
- Saving the result as JPEG, PNG, TIFF, or BMP
- Composing an XHTML `<img .../>` tag

What We'll Cover

- Using NSAnimation to liven up view state changes

- Leveraging the power of CoreImage in a Cocoa application

- Capturing view drawing using NSView "drawing redirection" methods

- Using an NSOpenGLContext with an ordinary NSView
- Creating a custom view class
  - Putting the view in an Interface Builder palette
  - Making the view's attributes bindable in Interface Builder

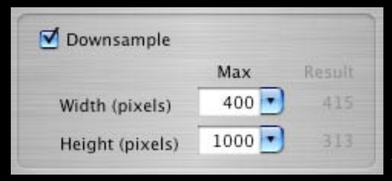
Demo

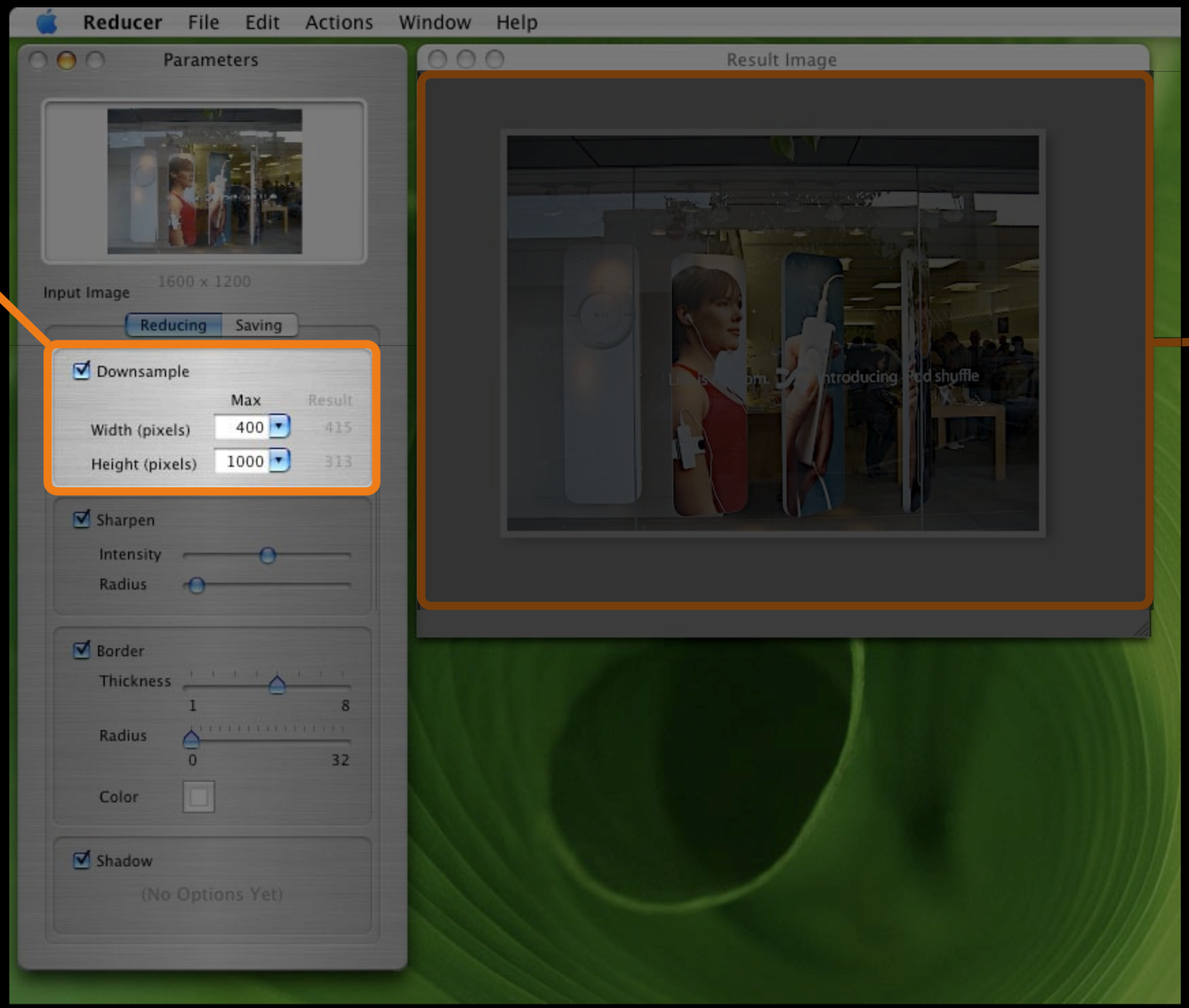
The “Reducer” Application

http://developer.apple.com/wwdc2005/

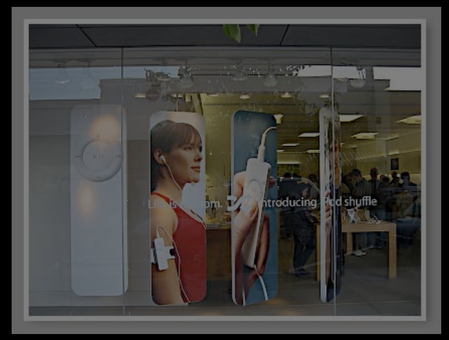
Custom Views for Today's Sample Project

CollapsibleBox





HybridImageView



Part 1. Making a Collapsible Box

http://developer.apple.com/wwdc2005/

Creating a Custom View Class

- Why do it?
  - To customize the appearance or behavior of an existing view or control
  - To define a brand-new NSView subclass for displaying and interacting with application-defined data
- We'll look at examples of both today

Implementing a "CollapsibleBox" View

- Subclass NSBox to inherit its nice border-drawing functionality
- And add an "expanded" Boolean attribute
- Implement KVC-compliant accessors for "expanded" attribute
  - Have `-isExpanded` report the current state
  - Have `-setExpanded:` remember the current frame size, and change the view's frame to match the new state
- Animate the transition to the new frame size

NSAnimation Classes

NSAnimation.h

NSAnimation

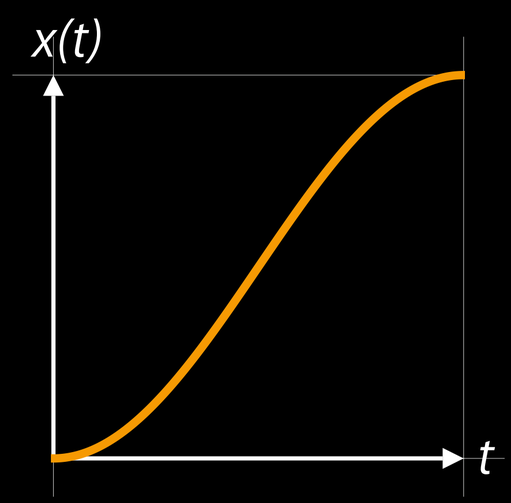
- Timing
- Start/Stop control and chaining
- Animation progress curves - *x(t)*
- Delegate mechanism

NSViewAnimation

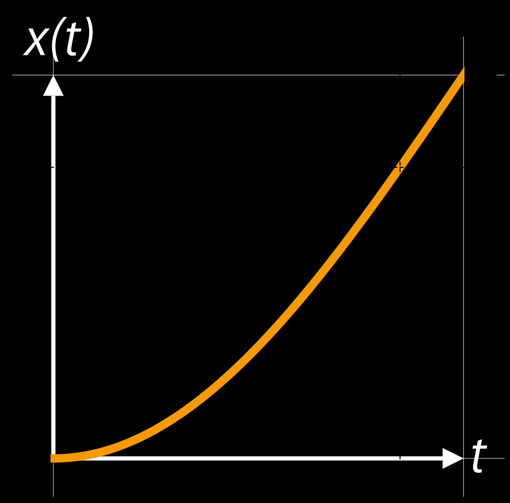
- Works with views and windows
- Move views around
- Animate view sizes, stretching and shrinking content
- Fade views in and out

Standard Animation Curves

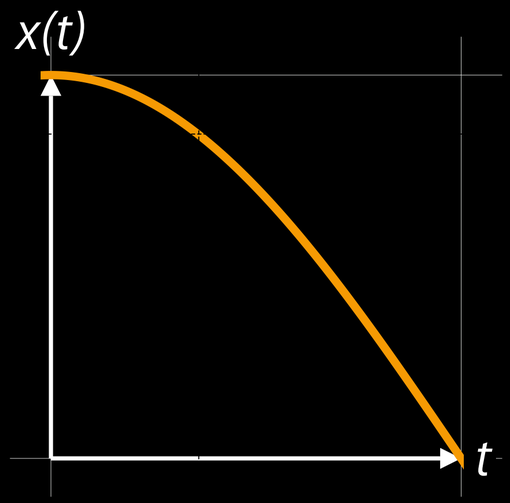
NSAnimation.h



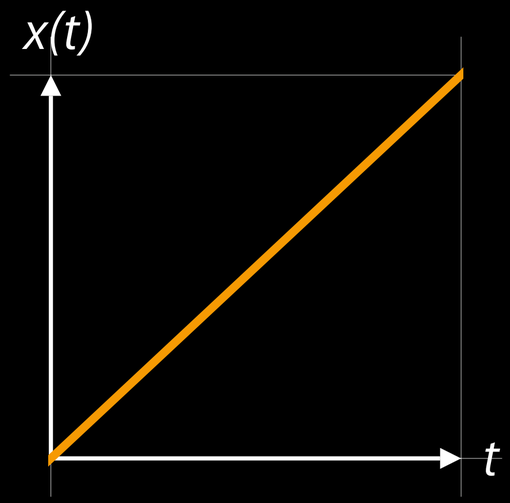
NSAnimationEaseInOut



NSAnimationEaseIn



NSAnimationEaseOut



NSAnimationLinear

- Sheets
- Drawers

Animating One or More Views

- Build the animation description (an NSArray of NSDictionary instances)
- Create an NSViewAnimation instance from the description
- Set duration, blocking mode, and optional delegate
- Start the animation
- Release the animation when done

Animating One or More Views

1. Assemble the list of animation descriptions, one per target

```
NSMutableArray *animationArray = [NSMutableArray arrayWithObjects:

    [NSDictionary dictionaryWithObjectsAndKeys:
        self,                                   NSViewAnimationTargetKey,
        [NSValue valueWithRect:oldFrame], NSViewAnimationStartFrameKey,
        [NSValue valueWithRect:newFrame], NSViewAnimationEndFrameKey,
        NSViewAnimationFadeOutEffect,     NSViewAnimationEffectKey,
        nil],

    // Add more animation description dictionaries here.

    nil
];
```

Animating One or More Views

2. Create an NSViewAnimation instance, and run the animation

```
NSAnimation *animation = [[NSViewAnimation alloc]
    initWithViewAnimations:animationArray];
[animation setAnimationBlockingMode:NSAnimationBlocking];
[animation setDuration:1.0];
[animation startAnimation];
[animation release];
```

Demo

Examining the “CollapsibleBox” Class

http://developer.apple.com/wwdc2005/

Animating a View Hierarchy

- Complex view tree animations might not “just work”
- As an alternative, you can use view autosizing with NSViewAnimation
  - Set desired autoresizing masks for views in the hierarchy
  - Drive the topmost view’s resize using an NSViewAnimation

Putting a View in a Palette

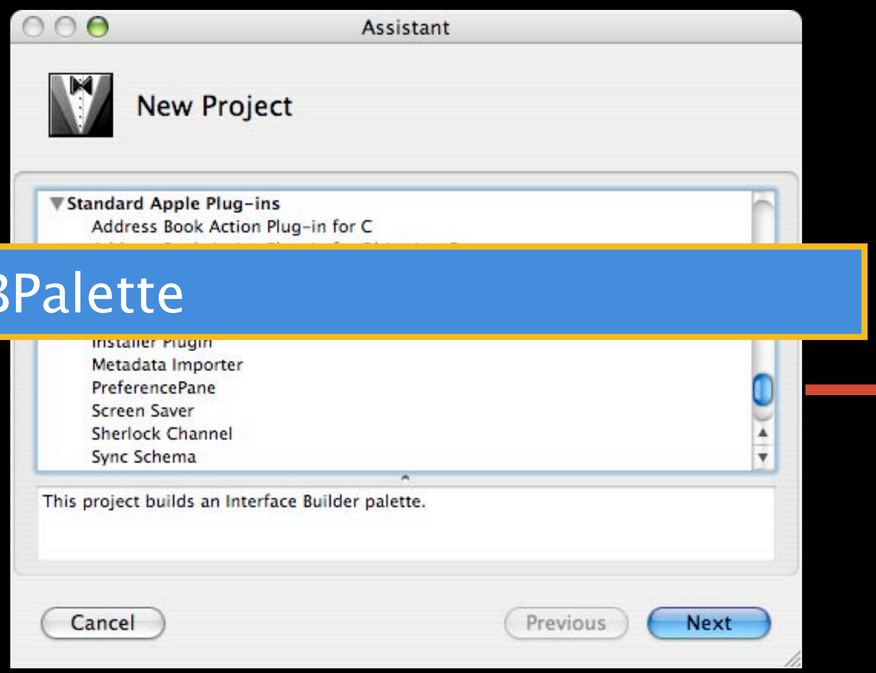
Why create a framework and palette for your custom view(s)?

- Make it easier to configure instances: visually in IB, using an inspector
- Views with a supporting palette are real, live objects in IB!
- Distribute your palettes of custom views, with the same IB-integration polish as standard AppKit views

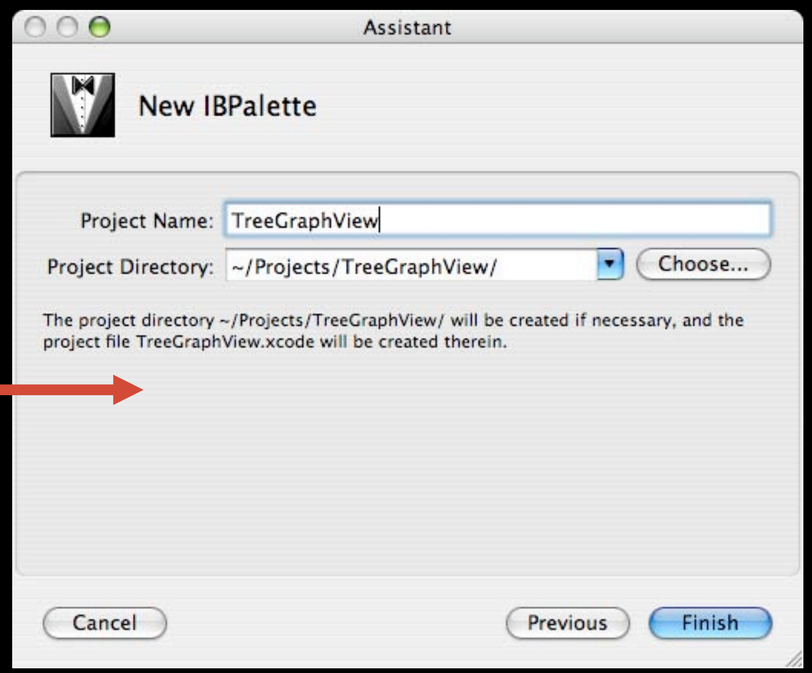
Creating an IB Palette Project in Xcode

File ➡ new project… ➡ standard Apple plug-ins ➡ IBPalette

Give the project the desired name of your view class (e.g. “CollapsibleBox”).



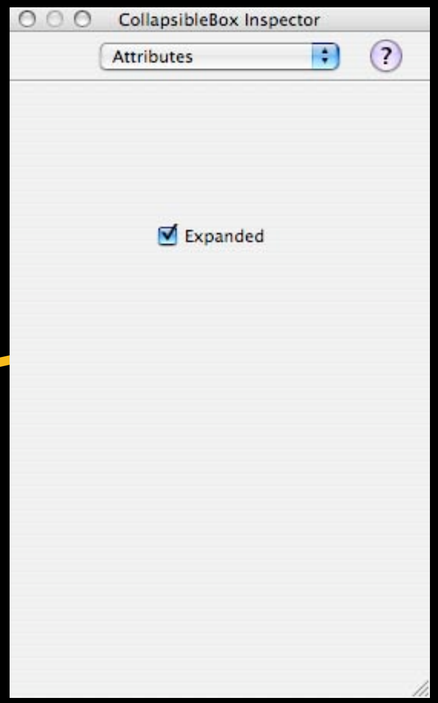
IBPalette

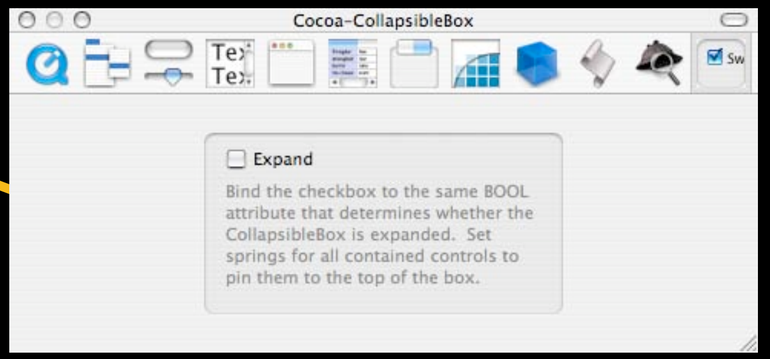


This creates a project with framework and palette targets.

Putting Your Custom View on a Palette

- In Xcode 2, this template creates a project with Palette and Framework targets
  - Framework
    - *MyView*
  - Palette
    - *MyView*Inspector
    - *MyView*Palette





Putting a View in a Palette

Further steps to make this work

- Required
  - Need to set classes for File's Owner in palette and inspector .nib files
  - Implement `-initWithCoder:` / `-encodeWithCoder:` for your view class
  - Implement setter accessors to do `[self setNeedsDisplay:]` as needed
  - Initialize your prototype view instance's attributes
- Optional polish
  - Build an inspector for your view's properties
  - Give the palette an icon (32 x 32 pixels)
  - Expose interesting attributes as bindable
  - Can use a placeholder in the palette instead of your view, if desired

Exposing Bindable Attributes

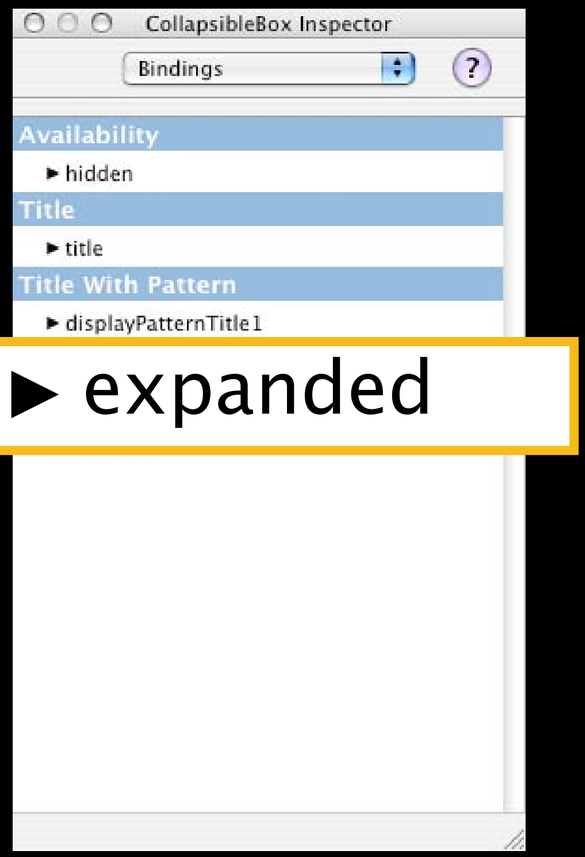
1. Provide KVC-compliant accessors

```
@implementation CollapsibleBox

- (BOOL) isExpanded {
    return expanded;
}

- (void) setExpanded:(BOOL)flag {
    if (expanded != flag) {
        expanded = flag;
        [self setFrameSize:otherFrameSize animate:YES];
    }
}

@end
```

Exposing Bindable Attributes in IB

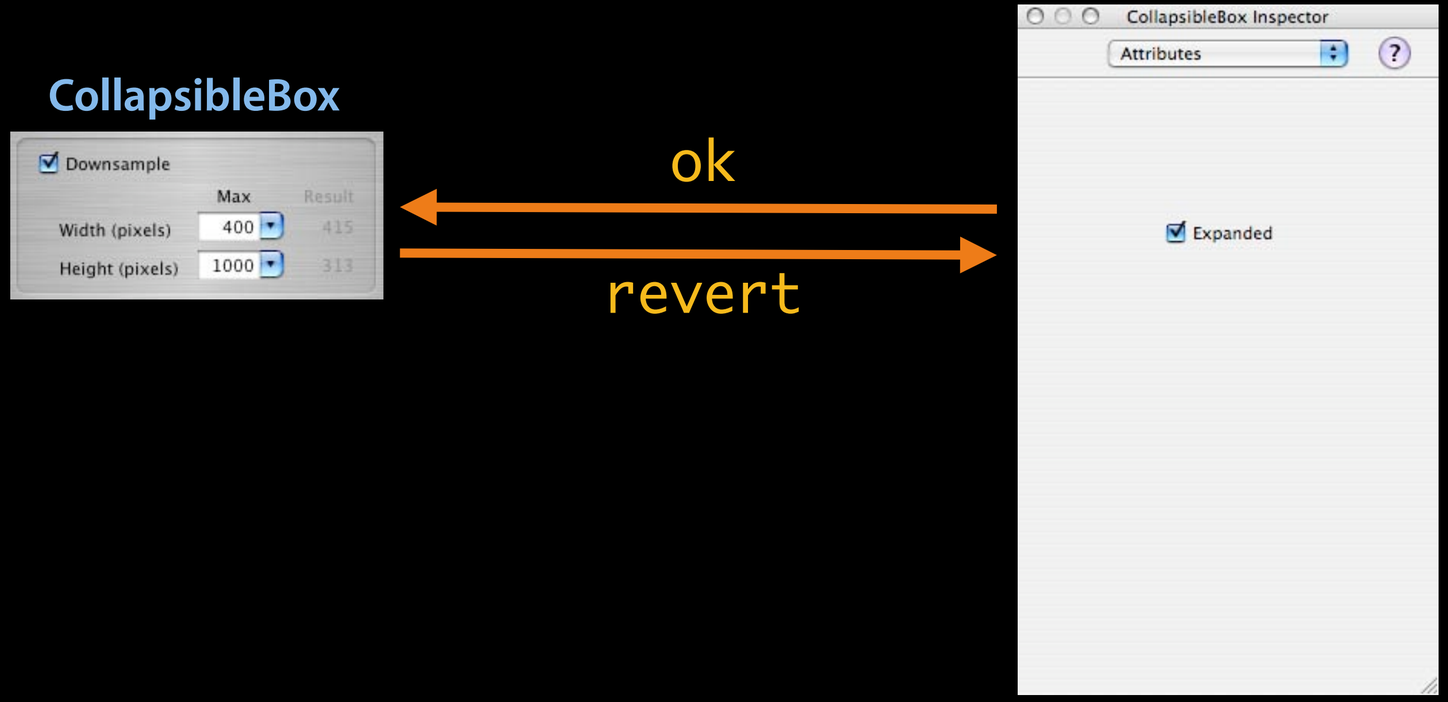
2. Declare each attribute (class `+initialize` is a convenient place)

```
@implementation CollapsibleBox

+ (void) initialize {
    if (self == [CollapsibleBox class]) {
        [self exposeBinding:@”expanded”];
        ...
    }
}

@end
```



Creating an Inspector For Your View

- Create outlets from "*MyView*Inspector" to its controls
- Wire your controls' actions to send "ok:" to the inspector
- Implement `-ok:` to pull controls' state into inspected view's properties
- Implement `-revert:` to push view's properties into controls' state



Finishing Prototype View Initialization

- Provide a common instance initialization method to be invoked when palette is initialized
- *MyView*Palette's -finishInstantiate is a good place to invoke this from

```
@implementation MyViewPalette

- (void)finishInstantiate {
    // Initialize the properties that MyView adds to its parent class.
    [myViewPrototype initAddedProperties];
}

...

@end
```

Demo

Examining the “CollapsibleBox” Palette

http://developer.apple.com/wwdc2005/

Part 2. A Hybrid Image View

Using OpenGL with AppKit Views

http://developer.apple.com/wwdc2005/

“ImageReducer” Class

Reducer’s image processing core

Parameters

ImageReducer

AppKit CoreImage Additions

Bridging the gap

NSColor.h

NSCIImageRep.h

AppKit

NSImageRep

NSBitmapImageRep

NSCIImageRep

```
+ (id)imageRepWithCIImage:(CIImage *)image;
- (id)initWithCIImage:(CIImage *)image;
- (CIImage *)CIImage;
```

NSColor

NSGraphicsContext

Core Image

CIImage

```
-drawInRect: fromRect:operation:fraction:
-drawAtPoint:fromRect:operation:fraction:
```

CIColor

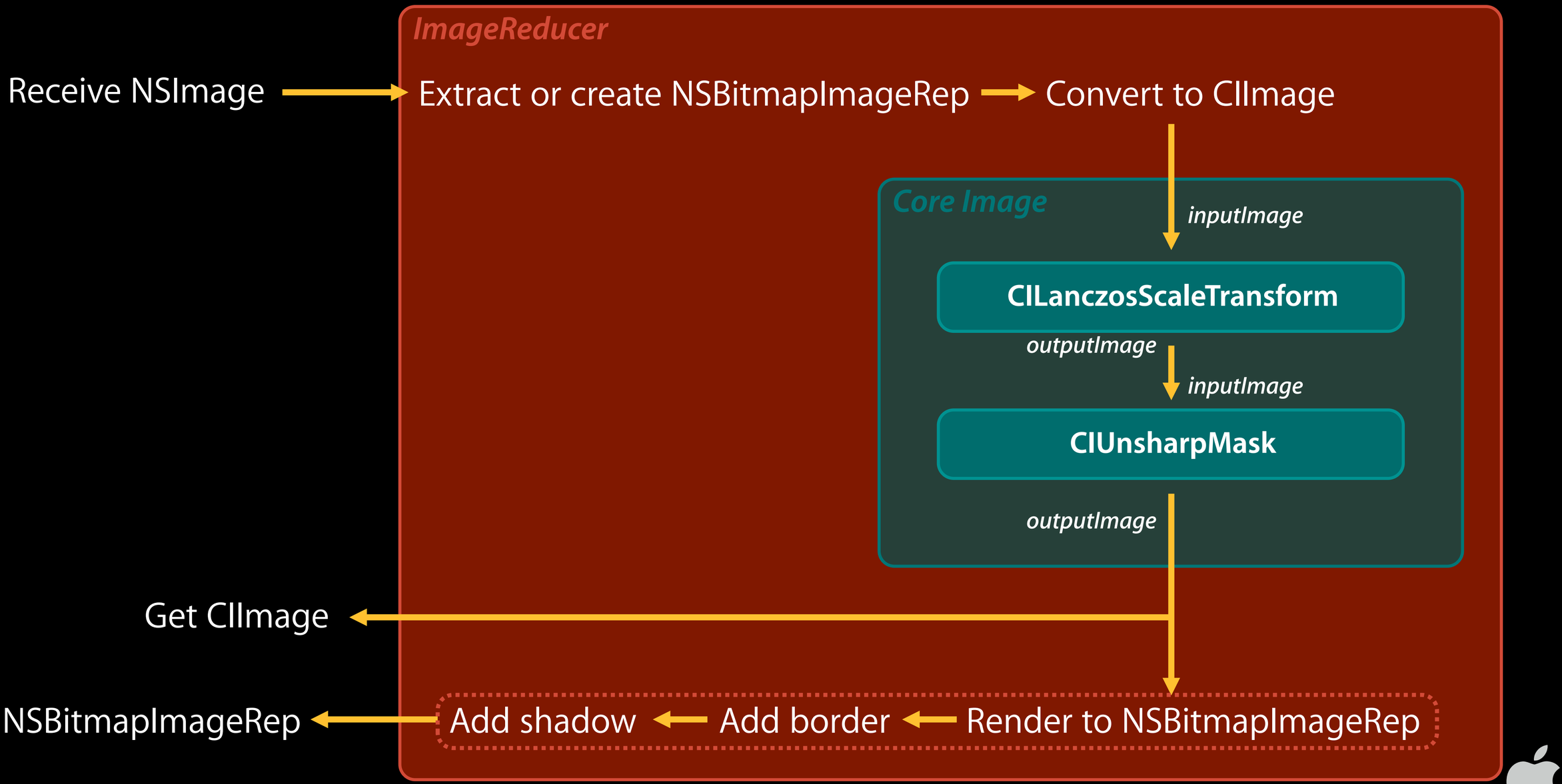
CIContext

-initWithColor:

+colorWithCIColor:

-CIContext

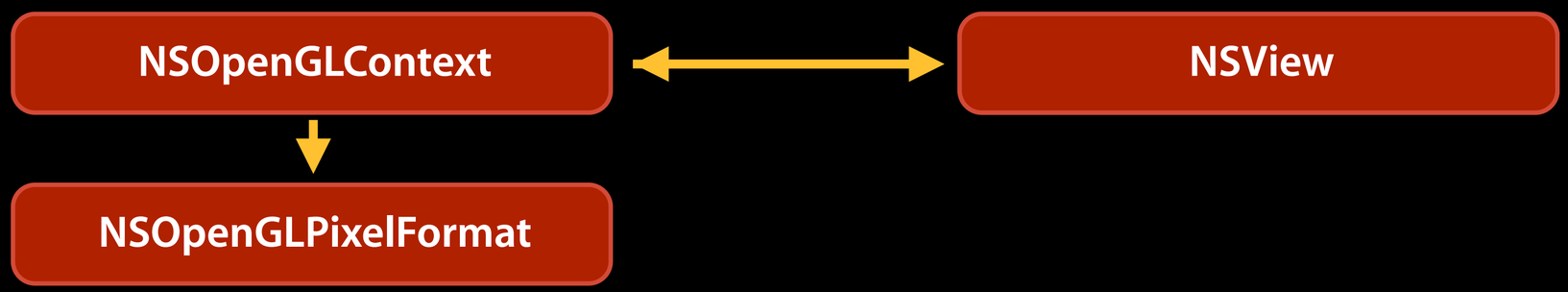
ImageReducer Class Internals



Implementing a “Hybrid” Image View

Using NSOpenGLContext with an ordinary NSView

```
- (void)setView:(NSView *)view;
- (NSView *)view;
```



Demo

“HybridImageView” in Action

http://developer.apple.com/wwdc2005/

Implementing a “Hybrid” Image View

Alternating between OpenGL and Quartz Drawing

- Switching to OpenGL drawing
  - Create an instance of NSOpenGLContext
  - Connect the context to the view using `-setView:`
  - Make the context current using `-makeCurrentContext`
  - Perform OpenGL initialization using the OpenGL API
  - Draw the view’s content using `gl...()` calls!
  - Optionally, send `[window disableScreenUpdatesUntilFlush]`
    - Prevents “flash” of surface content before it has been initialized by your app

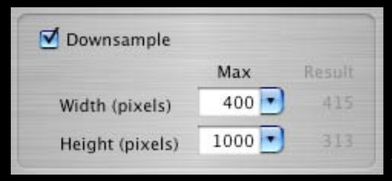
Implementing a “Hybrid” Image View

Alternating between OpenGL and Quartz Drawing

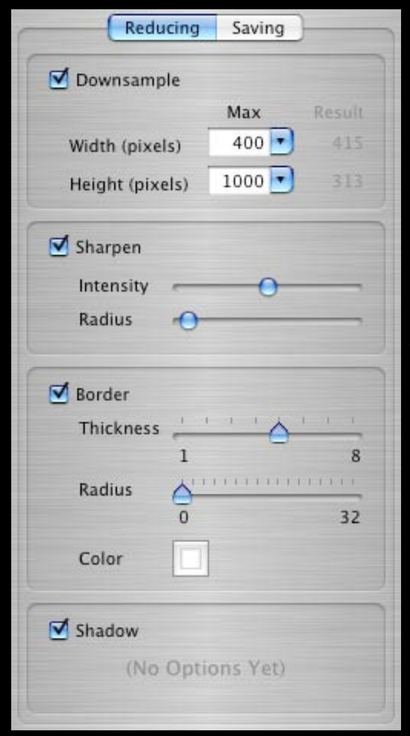
- Switching back to Quartz drawing
  - Dismiss the context’s surface using `-clearDrawable`
  - Release the NSOpenGLContext instance
  - Draw the view’s content using Cocoa and Quartz APIs.
  - Optionally, send `[window disableScreenUpdatesUntilFlush]`
    - Prevents “flash” of window backing store before it has been initialized

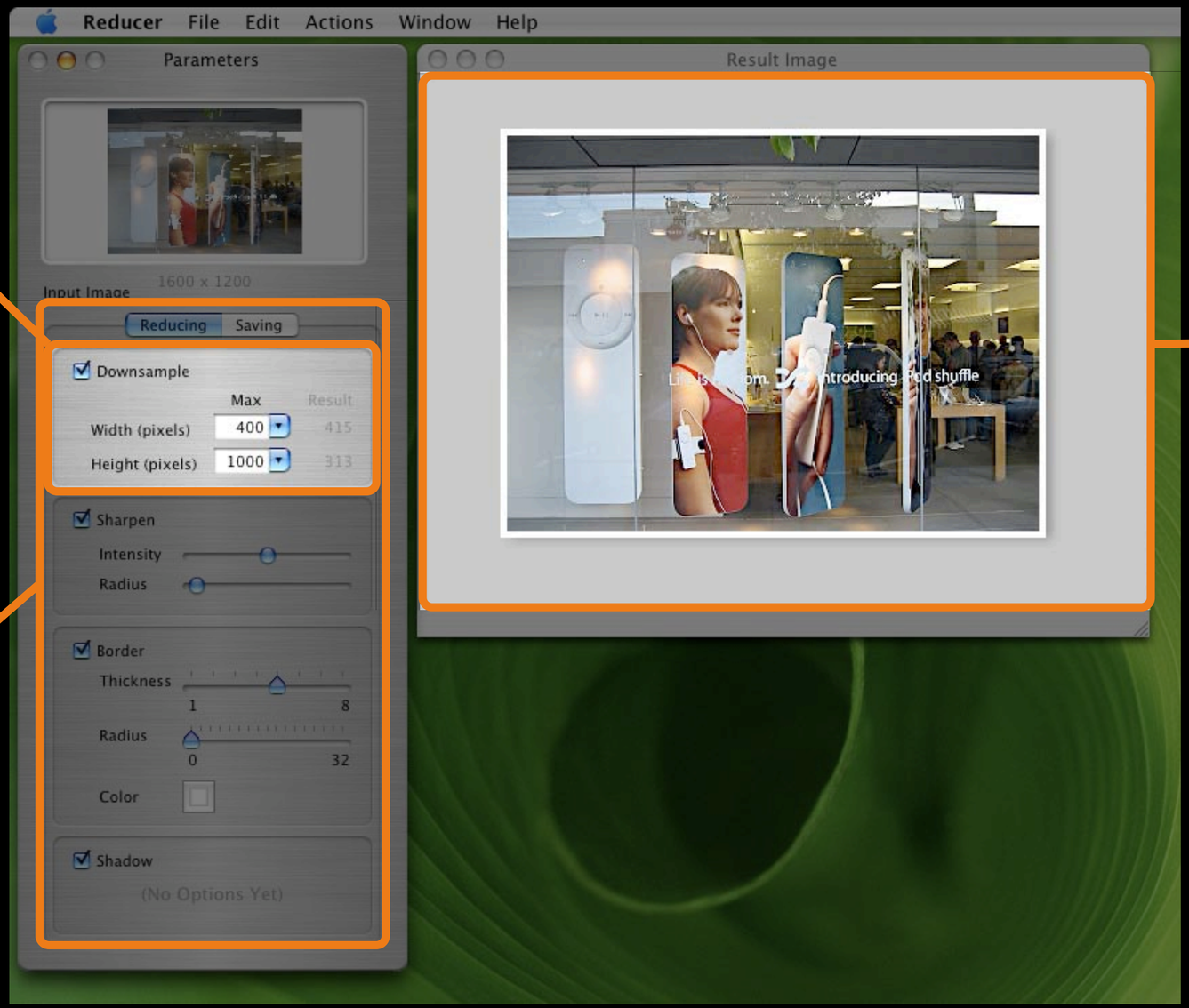
Custom Views for Today's Sample Project

CollapsibleBox



AnimatingTabView





HybridImageView

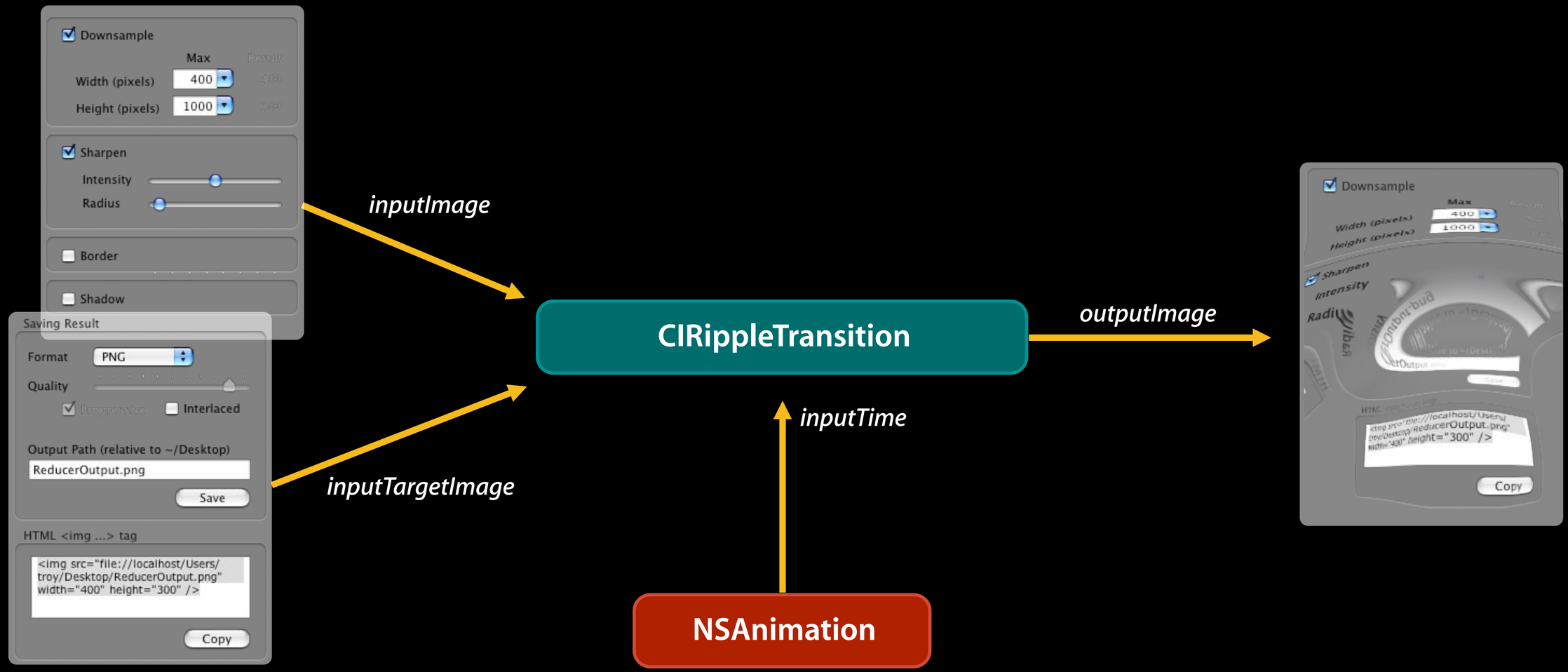
Part 3. Animating a Tab Switch

Using CoreImage with View Drawing Redirection

http://developer.apple.com/wwdc2005/

Animating a Tab Switch

View Drawing Redirection + Core Image + NSAnimation



Capturing View Content

Two approaches

Grab from Window Backing Store

```
NSRect rect = [view bounds];
[view lockFocus];
NSBitmapImageRep *bitmap =
    [[NSBitmapImageRep alloc]
    initWithFocusedViewRect:rect];
[view unlockFocus];
```

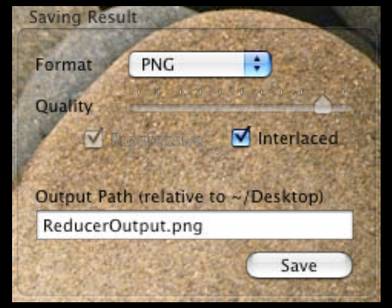
View must be in a window (offscreen OK)

Result includes window background

Draw View into a Bitmap new

```
NSRect rect = [view bounds];
NSBitmapImageRep *bitmapImageRep =
    [view bitmapImageRepForCachingDisplayInRect:rect];
[view cacheDisplayInRect:rect
   toBitmapImageRep:bitmapImageRep];
```

Window not necessary



Result can include transparent areas

Drawing "Redirection" Methods

NSView

High-Level

```
- (NSBitmapImageRep *) bitmapImageRepForCachingDisplayInRect:(NSRect) rect;
- (void) cacheDisplayInRect:(NSRect) rect
         toBitmapImageRep:(NSBitmapImageRep *) bitmapImageRep;
```

Funnel Point

```
- (void) displayRectIgnoringOpacity:(NSRect) aRect
                          inContext:(NSGraphicsContext *) context;
```

NSGraphicsContext

```
+ (NSGraphicsContext *)
    graphicsContextWithBitmapImageRep:(NSBitmapImageRep *) bitmapRep;
```

Demo

“AnimatingTabView”

http://developer.apple.com/wwdc2005/

Conclusion

http://developer.apple.com/wwdc2005/

Topics Covered

- Using NSAnimation to liven up view state changes

- Leveraging the power of CoreImage in a Cocoa application

- Capturing view drawing using NSView “drawing redirection” methods

- Using an NSOpenGLContext with an ordinary NSView
- Creating a custom view class
  - Putting the view in an Interface Builder palette
  - Making the view’s attributes bindable in Interface Builder

More Information

http://developer.apple.com/wwdc2005/

Documentation, Sample Code, and Other Resources

http://developer.apple.com/wwdc2005/

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